JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES
VOL. II, MAY 4, 1912 No. 9

CHEMISTRY.—*The ammonia system of acids, bases and salts.* EDWARD C. FRANKLIN, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service. To appear in full in the American Chemical Journal.

A consideration of the may points of resemblance between water and liquid ammonia[1] as electrolytic solvents has led the writer to the conception of a system of acids, bases and salts in which ammonia occupies a position similar to that held by water in its relation to the ordinary oxygen acids, bases and salts. The compounds which are thus related to ammonia are respectively the familiar acid amides, the less familiar metallic amides and imides and the metallic derivatives of the acid amides and imides.

The formal analogies between the typical substance, water, with its family of derivatives, the aquo acids, aquo bases and aquo salts on the one hand, and ammonia with its derivatives, the ammono acids, ammono bases and ammono salts, on the other, will be clear from an inspection of the following table in which are given the names of formulas of a number of representatives of each class.

Nor are the analogies thus indicated merely formal, for the well known properties which characterize the ordinary acids, bases and salts are found to attach also to the ammonia derivatives as follows: (1) Liquid ammonia solutions of the ammono acids, bases and salts are conductors of electricity, which property, it

[1] Not the familiar aqua ammonia, but pure ammonia gas liquefied by pressure or low temperature.

will be remembered, is exhibited by the corresponding water derivatives to a conspicuous degree. (2) Ammono acids and bases[2] produce the familiar reciprocal color changes in liquid ammonia solutions of phenolphthalein and other indicators. (3) When an ammono acid and an ammono base are brought together in liquid ammonia solution a reaction takes place resulting in the formation

TABLE 1

THE WATER SYSTEM		THE AMMONIA SYSTEM	
Aquo acids		*Ammono acids*	
Acetic acid	CH_3COOH	Acetamide	CH_3CONH_2
Nitric acid	NO_2OH	Nitramide	NO_2NH_2
Carbonic acid	$CO(OH)_2$	Urea	$CO(NH_2)_2$
Sulphuric acid	$SO_2(OH)_2$	Sulphamide	$SO_2(NH_2)_2$
Orthosilicic acid	$Si(OH)_4$	Silicon amide	$Si(NH_2)_4$
Aquo bases		*Ammono bases*	
Potassium hydroxide	KOH	Potassium amide	KNH_2
Zinc hydroxide	$Zn(OH)_2$	Zinc amide	$Zn(NH_2)_2$
Lead hydroxide	$Pb(OH)_2$	Lead amide	$Pb(NH_2)_2$
Aquo salts		*Ammono salts*	
Potassium acetate	CH_3COOK	Monopotassium acetamide	CH_3CONHK
Potassium carbonate	$CO(OK)_2$	Dipotassium acetamide	CH_3CONK_2
Mercuric nitrate	NO_2Ohg	Dipotassium urea	$CO(NHK)_2$
		Mercuric nitramide	NO_2NHg

of an ammono salt. For example, acetamide acts upon potassium amide in accordance with the equations

$$CH_3CONH_2 + KNH_2 = CH_3CONHK + NH_3$$

$$CH_3CONH_2 + 2KNH_2 = CH_3CONK_2 + 2NH_3$$

to form monopotassium or dipotassium acetamide. (4) Liquid ammonia solutions of ammono acids attack certain metals with the evolution of hydrogen gas and the formation of ammono salts as represented for a specific example by the equation,

$$Mg + 2CH_3CONH_2 = (CH_3CONH)_2Mg + H_2$$

[2] Ammonia itself exhibits basic properties only in the presence of water. It is not surprising therefore to find that the dry liquid acts quite as indifferently towards indicators as does water itself.

The products of the action of acetamide on metallic magnesium are magnesium acetamide, an ammono salt, and hydrogen. (5) As potassium hydroxide in aqueous solution dissolves metallic zinc to form potassium zincate, so a liquid ammonia solution of potassium amide attacks the same metal with the evolution of hydrogen and the formation of a beautifully crystalline potassium ammonozincate. The action is represented by the equation

$$Zn + 2KNH_2 = Zn(NHK)_2 + H_2$$

(6) Just as the soluble alkali hydroxides when added to aqueous solutions of the salts of the heavy metals brings about the precipitation of the hydroxides or oxides of the latter, so the analogous metallic amides, imides and nitrides are formed when potassium amide is added to solutions of the salts of the heavy metals in liquid ammonia. Silver iodide is readily soluble in liquid ammonia. When potassium amide is added to such a solution a precipitate of silver amide is formed in accordance with the equation

$$AgI + KNH_2 = AgNH_2 + KI$$

In a similar manner a soluble lead salt when treated with a solution of potassium amide gives a precipitate of lead imide, PbNH, and a soluble mercuric salt a precipitate of mercuric nitride, Hg_3N_2. (7) A considerable number of ammonia analogs of the compound formed by the solution of the hydroxides of certain heavy metals in aqueous solutions of alkali hydroxides have been prepared by the action of liquid ammonia solutions of potassium amide on the amides and nitrides of a number of heavy metals. For example a beautifully crystalline ammonoplumbite has been prepared in accordance with the reaction represented by the equation

$$PbNH + KNH_2 = PbNK + NH_3$$

The analogous reaction in the water system taking place in aqueous solution may be represented by the equation

$$Pb(OH)_2 + 2KOH = Pb(OK)_2 + 2H_2O$$

The preparation of potassium ammonoplumbite and of other ammono salts of this class is especially interesting in view of the fact that the analogous aquo salts have never been satisfactorily isolated. (8) The analogies between the water system and the

ammonia system extends to the formation of ammonobasic salts, that is to say to the formation of compounds which are related to ammonia as the ordinary aquobasic salts are related to water. For example, mercuric chloride in the presence of liquid ammonia undergoes ammonolysis in a manner represented by the reversible equation

$$HgCl_2 + 2NH_3 = Hg\begin{<}{Cl}{NH_2}\end{} + NH_4Cl.$$

The formation of ammonium chloride[3] limits this ammonolytic reaction just as the liberation of acid brings to an end the familiar hydrolytic decomposition of salts of weak bases in water solutions.

In the longer paper the many points of resemblance between water and ammonia are enumerated; a system of nomenclature is outlined and an account is given of a considerable number of typical reactions and new compounds of the ammonia system.

BOTANY.—*Jointed leaves of Amygdalaceae.* O. F. COOK. Bureau of Plant Industry.

The leaves of the plum, peach, and apricot have a joint at the base, just above the insertion of the stipules, as do many leguminoseae. The basal section of the leaf, below the joint is in all cases short, but is often as long as broad, and is the part to which the stipules are attached. It does not fall off with the petiole but remains alive and serves as a supplementary bud-scale. The stipules are deciduous at an early stage, a fact which may have allowed the persistance of the base of the leaf to remain overlooked.

It is not to be supposed, of course, that this specialization has remained entirely unnoticed by preceding observers, but Sargent and other authorities do not allude to it further than to state that

[3] Ammonium salts, whether of aquo acids or halogen acids, in solution in liquid ammonia show certain truly acid properties. They bring about the reversal of ammonolytic reactions, they dissolve many metallic oxides, they attack certain metals with the evolution of hydrogen and they discharge the red color of alkaline phenolphthalein solutions. Their solutions in liquid ammonia are excellent conductors of electricity.

the stipules are distinct from the petiole, and the botanical significance of this fact is not pointed out. The reader is left to infer that the stipules are attached directly to the branch, for nothing is said of another foliar element below the base of the petiole.

Without attempting to determine whether this joint in the leaves of the Amygdalaceae is truly homologous with the leaf-articulations of leguminoseae, it is at least to be considered as a vegetative character that sets the Amygdalaceae one stage farther away from the Malaceae and true Rosaceae. Botanists have long recognized a very close approximation between the rosaceous and leguminous series. Such types as Chrysobalanus have often been passed back and forth between the two series by different authorities on classification. Some botanists may not consider tha attachment of the stipules as a sufficient indication that the persistent base is really a part of the leaf instead of an outgrowth from the internode. But it is believed that a comparison of the stone fruits with other rosaceous types will convince most observers on this point.

Reduced to the simplest terms of morphology, the leaves of the higher plants, including the monocotyledons, consist of two structural elements, a more or less sheathing base and a more or less expanded blade. The petiole is a secondary specialization, in some cases representing an elongation of the upper part of the basal sheath, in others a narrowing of the lower part of the blade. In the fan-palms the petiole is a part of the leaf sheath, with the ligule at the end, while in Desmoncus and other related genera of Cocaceae, the ligule is below the petiole which evidently represents only the naked base of the rachis.

In most of the dicotyledonous families the sheathing character of the basal element has been lost, but in this respect the Rosaceae, Ranunculaceae and related families are less specialized, so that there can be little question of the homology of the stipular portions of the leaves with the bud-scales and sheaths of Artocarpaceae, Piperaceae, aroids and palms.

The leaf-bases of the Amygdalaceae are able to persist because of the joint that allows the petiole to separate and fall off with the blade at the end of the season. At San Antonio, Texas, where

these facts were first noticed, the persistent leaf-base of the peach remains alive for a year or for two but finally dies and withers away. In Maryland peach trees the petiole base lives through the winter and separates when the buds start in the spring, leaving a fresh green leaf-scar.

The apple and its relatives do not share these specialized leaf characters of the stone fruits. There is no joint above the attachment of the stipules and basal section of the leaf falls off with the rest. The stipules of the quinces are much closer to the base of the leaf than those of the apple, and might be supposed to have a separate attachment to the branches. But on "water shoots" of Chinese quinces at San Antonio some of the stipules were of very large size and had strongly dentate margins. In these cases there could be no question regarding the attachment of the stipules to the petiole.

Another fact that may indicate greater complexity of leaf structure among the ancestors of the Amygdalaceae is the presence of small oblong or spatulate leafy organs on the upper part of the petiole, taking the place of nectaries. In some varieties of apricots these small accessory blades are of frequent occurence. They suggest the possibility that the nectaries of the petioles of Amygdalaceae may correspond to the marginal glands of the blade and may represent rudiments of divisions of compound leaves. If this be true the petiole in this group may correspond to the rachis of a compound leaf rather than to the more specialized petioles of some of the simple-leaved families.

BOTANY.—*Merotypes as a means of multiplying botanical types.* WALTER T. SWINGLE, Bureau of Plant Industry.

Type specimens are now the most treasured possessions of natural history museums. The type specimen of an organism constitutes a fixed point in the taxonomic survey of the group of individuals which make up the species, and while it may not be typical of the latter in the ordinary English sense, it does at least determine one form which must remain in the species no matter how opinions may vary as to its limits.

It is now generally held that only one specimen is to be regarded

as the true type (holotype), all others studied by the author in describing his species being paratypes or cotypes.

It is becoming increasingly evident that the views of an author as to the limits of a new species are only too often considerably modified or even completely changed by subsequent research. This means that a paratype or even a subsequently collected specimen considered by the author to be practically a duplicate of the type cannot have anything like the same value in taxonomic work as the true type itself.

It has not been adequately realized that the botanist often has it in his power to collect a large number of specimens from the plant that yielded the type and that if these specimens represent homologous organs they may be practically equal to the type itself for taxonomic study. This is because the plant body is usually composed of homologous nodes or metamers[1] so that a branch if selected with care, is almost absolutely identical with the type specimen itself. In many cases it is even possible to multiply such plants indefinitely by vegetative propagation, thereby producing a practically unlimited number of such specimens. Trees or shrubs often can furnish scores or even hundreds of specimens practically identical with the type specimen and of very much greater value from a taxonomic point of view than specimens taken from other individuals, no matter how closely these latter may resemble the type plant.

In the case of trees, shrubs and perennial herbs, it is furthermore possible to collect fresh sets of specimens in subsequent years from the type plant, thereby rendering it possible to send specimens to all parts of the world.

The word *merotype*[2] has been proposed to designate such specimens and may be defined as follows:

Merotype (μέρος a part; τύπος a type). A part of the individual organism that furnished the type specimen of a new species, such part usually containing organs homologous to those represented in the type specimen.

[1] Cook, O. F., Dimorphic branches in tropical crop plants, Bull. 198, Bur. Pl. Ind., U. S. Dept. Agr., p. 8. Jan. 14, 1911.

[2] This word was first defined in this Journal 2: 212 as follows: "Merotype, (μέρος a part; τύπος type) in taxonomy, a part of an organism that furnished the type specimen of a new species,"

Merotypes secured at the very time the type specimen was collected and which might be called synchronous merotypes have, of course, the highest value in taxonomy since there is almost no chance of error through mistaking another individual plant for the one that yielded the type. If studied by the author prior to publishing the species merotypes may also be paratypes and as such have still greater authenticity and value.

Merotypes collected later may differ more or less in their characters because of climatic or other environmental factors varying in different seasons. Still, such subsequently collected merotypes are of great value and if chosen carefully may have almost the value of synchronous merotypes.

It is to be hoped that in future botanists and collectors will arrange to label in some permanent way and to indicate clearly the exact location of trees or other perennial plants from which important specimens are collected which may by any chance be used as the basis for describing a new species. Of course it is imperative that the collector keep the material from this one plant distinct from any material that may be collected from other plants no matter how similar such plants may appear to be. In this way a collector can often provide a supply of merotypes which the author of the species may arrange to distribute to other specialists in his group and to the principal herbaria of the world.

BOTANY.—*A method of preserving type specimens.* MAUDE KELLERMAN, Bureau of Plant Industry, communicated by Walter T. Swingle.

As the importance of type specimens is more and more recognized by taxonomists of the present day, the necessity not only for fixed rules governing their selection but also some practical method for their preservation becomes apparent. The botanist, at any rate, cannot hope to bequeath his types to future generations with prevailing herbarium methods. Many type specimens are so fragile that even enclosing each sheet in a species cover is a very inadequate protection.

For type specimens, especially those of a fragile nature, a new method of preservation has been found that promises to be satis-

factory. This consists in the use of shallow cardboard boxes covered with binder's cloth and having a glass top. The box is about a half inch deep and is filled with several layers of cotton. The specimen is laid on the cotton, which presses it up against the glass cover when the mount is closed. The cover is held in place by long pins. Any fragments may be enclosed in small pockets of transparent paper. A small piece of Japanese lens paper placed under small or woolly portions of the plant will prevent their becoming enmeshed in the cotton. The label is placed under the glass at one corner as on regular herbarium sheets. A second label may be pasted on the lid so that the specimen can be found at once when in a herbarium case, without pulling out the box to see the label inside. Small pieces of camphor in the corners of the box will effectually prevent the entrance of insects. Mounted in this way the specimen is protected from dust and the danger of breakage to which it is exposed if mounted on a regular herbarium sheet. It may be examined without handling, and when using a lens for close study it is scarcely possible to detect the presence of the glass over the plant. At the same time access to it is possible in case it is necessary to study the reverse side of some part of the plant. Any original labels may be placed inside the box, thereby preventing their loss or separation from the specimen.

Specimens which are too thick to be mounted as described above may be placed in boxes from one to two inches thick. Such specimens often cannot be mounted in the ordinary way without danger of breakage and loss. Specimens with loose leaves may be temporarily reconstructed in such boxes, whereas one would hesitate to mount these leaves in a permanent manner. Minute fragments of types which would inevitably crumble away if mounted in the usual manner or enclosed in pockets may be placed in smaller boxes of this kind, and these boxes arranged in trays (with or without glass tops) the size of a herbarium sheet.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

GEOLOGY.—*A geologic reconnaissance of the Iliamna region, Alaska.* G. C. MARTIN and F. J. KATZ. Bulletin U. S. Geological Survey No. 495, pp. 138, with maps, sections, and views. 1912.

The Iliamna region, as here defined, covers an area of about 5000 square miles, situated in southwestern Alaska, west of the southern half of Cook Inlet and north of the Alaska Peninsula. Most of this field is new to the geologist, and the work accomplished contributes facts, particularly with reference to the Mesozoic sequence, which may help elucidate the stratigraphy and structure of adjacent districts.

The general stratigraphic section includes Quaternary deposits; Tertiary basaltic flows and tuffs, with some sedimentary beds; upper and Middle Jurassic shales, sandstones, and conglomerates; Lower Jurassic porphyries and tuffs; Upper Triassic limestone and chert; early Triassic or late Paleozoic greenstone and slate; and Paleozoic gneiss, schist, and crystalline limestone.

The more important stratigraphic features of this region are the recognition of the highly metamorphosed and presumably early Paleozoic gneisses in a district where they had not been previously known; the description of a newly discovered Triassic limestone containing an interesting coral reef fauna of Noric age, which extends the known distribution of Triassic reef corals into a latitude (60° N.) far beyond their previously known range; the re-definition of the Jurassic formations of Cook Inlet, which, because of the stratigraphic completeness of their development and the abundance and variety of the fossils of their several faunas and floras, constitute the best Jurassic section in North America; and the recognition of a large area of Tertiary lavas. The provisional lists of fossils consist however, chiefly of undescribed species.

The detailed structure of the district is largely unknown, but in general the Paleozoic rocks are severely deformed by folding and are metamorphosed; the Triassic rocks are strongly folded, the Jurassic rocks moderately flexed, and younger formations are flat or only slightly inclined. Triassic rocks are locally thrust upon Upper Jurassic rocks and normal faulting has affected all pre-quaternary systems. The principal structural trend is northeast and southwest. There were great abysmal intrusions during the Lower or Middle Jurassic, and there has been volcanic activity in Triassic, Lower Jurassic, Upper Jurassic, Tertiary, and Recent times.

The entire region was glaciated during the Quaternary, and a few small glaciers still persist.

The principal copper prospects of the region are in limestones at or near the contacts of greenstone and of granite. Others are in quartz veins traversing greenstone and granite. The silver prospects are manganiferous sphalerite-galena veins in limestones. The gold prospects are in pyritized fracture zones in granite and in quartz-latite tuffs, and these are reported gold placers. Petroleum seepages occur along the outcrop of the Middle and Upper Jurassic rocks. G. C. M.

GEOLOGY.—*Geology and coal fields of the lower Matanuska valley, Alaska.* G. C. MARTIN and F. J. KATZ. Bulletin U. S. Geological Survey No. 500, pp. 98 with maps, sections, and views. 1912.

The coal field, situated in the lower part of the Matanuska valley, in the south-central part of Alaska, is one of the most important in Alaska. About 200 square miles of this region, including the larger part of the known coal field, has been mapped on a scale of 1 : 62,500, while adjacent areas have been covered by reconnaissance surveys.

The stratigraphic sequence within the area studied in detail includes Lower Jurassic, Lower (?) and Upper Cretaceous, Tertiary, and Quaternary deposits. There are also granitic masses of Mesozoic age, and intrusive diorite porphyries; trachytic rocks, and diabase and gabbro of Tertiary age. In addition to these rocks there are, in the surrounding region, Paleozoic or early Mesozoic schists, slates, graywackes, and greenstones, Middle and Upper Jurassic shales, sandstones, and conglomerates. The provisional lists of fossils include marine invertebrates from Lower, Middle, and Upper Jurassic and Upper Cretaceous horizons, together with Tertiary and possibly Upper Cretaceous plants.

The great structural feature of the region is the fault or fault zone which marks the straight south front of the Talkeetna mountains and

parallels the general course of the Matanuska river. The nearly parallel northern edge of the Chugach mountains may also be determined by faulting. In the valley the sedimentary rocks have been strongly folded. In most places definite structual details could not be determined. Two broad simple synclines which are modified by bounding fault planes are known.

The coal of the Matanuska Valley occurs in several isolated fields, only part of which are included in the area here described. The coal ranges in character from low-grade bituminous to a good grade of semi-bituminous, there being a progressive increase in degree of alteration from west to east. F. J. K.

HYDROLOGY.—*Ground water in Juab, Millard, and Iron counties, Utah.* O. E. MEINZER. Water-supply Paper, U. S. Geological Survey, No. 277, pp. 162, with maps and diagrams. 1911.

Juab, Millard, and Iron counties which lie in western Utah, are occupied by desert plains interrupted by Basin ranges, and are bounded on the east by the Plateau province. The formations exposed range from Pre-Cambrian to Recent. Much of the desert was covered by ancient Lake Bonneville and is underlain by lake beds.

Water is found chiefly in unconsolidated sediments confined within rock basins, igneous rocks forming more impervious basins than limestones. Alkali flats indicate the water level and therefore serve as guides in prospecting for underground supplies. Flowing wells are obtained from the unconsolidated sediments but not from the rock formations.

Characteristic of the region are large "pool" and "knoll" springs that yield warm water and are apparently related to faults. The pools are deep reservoirs bordered by projecting shelves formed of vegetable fibers and wind-deposited sand and dust. The knolls are a development of these shelves. Their flow is inversely proportional to their height, and their growth is limited by the hydrostatic head of the water.

O. E. M.

HYDROLOGY.—*Geology and water resources of Eastancia Valley, New Mexico, with notes on ground-water conditions in adjacent parts of central New Mexico.* O. E. MEINZER. Water-Supply Paper U. S. Geological Survey No. 275, pp. 69, with maps and illustrations. 1911.

The drainage basin of Estancia Valley, New Mexico, has an area of about 2000 square miles and forms a depression that has no outlet. Pre-Carboniferous crystallines, Carboniferous and Cretaceous sediments,

and later intrusives constitute the rock formations of the basin. The Carboniferous contains red beds and thick ledges of gypsum. Alluvial, lake, and wind deposits and precipitates from solution cover the rock floor of the valley. The lake beds are finely laminated; the wind deposits include dunes of gypseous dust or clay 100 feet high; the precipitates include one bed of common salt that is commercially valuable. In Pleistocene time a lake 450 miles in area occupied the basin, the strand of which is marked by ancient cliffs, terraces, beach ridges, spits, and bars. Post-lacustrine wind erosion has formed numerous basins with steep walls and flat bottoms that coincide with the ground-water level.

Encino and Pinos Wells valleys are small undrained depressions east of Estancia Valley. The former held a Pleistocene lake about 18 square miles in area, as is shown by an ancient strand and stratified beds, and has both pre-lacustrine and post-lacustrine wind deposits. Flat-bottomed, wind-scooped basins, characteristic of Estancia Valley, are found also in both of these valleys. The susceptibility of the clay to wind erosion is probably due to its gypsiferous character. Typical gypsum sand occurs in the Pinos Wells depression. O. E. M.

PHYTOPATHOLOGY.—*A plant disease survey in the vicinity of San Antonio, Texas.* FREDERICK D. HEALD and FREDERICK A. WOLF. Bulletin Bureau of Plant Industry No. 226, pp. 129, text figs. 2, plates 19. 1912.

The authors report a plant disease survey made during the summer and fall of 1909 and the winter and spring of 1910, in the area comprised within a circle having a radius of 100 miles from San Antonio, Texas. This region occupies the coastal plain of Texas in the south and east and extends into the Edwards Plateau and Llano country in the northwest. Maps show the places visited and the rainfall for 1909. Tables give the elevation of the principal stations, the annual precipitation for 1909 at 24 points, the maximum, minimum, and mean temperatures, and the average daily evaporation at the San Antonio Experiment Farm. The rainfall of the area studied is limited, ranging for the most part from 20 to 30 inches, while one-half of the area had a total annual precipitation of only 10 to 20 inches. The temperatures in summer are high and the evaporation large. The authors describe the crops and native vegetation of the area, and discuss the relation of the environmental factors to the plant diseases found. Chlorosis, probably due to excess of lime and to drought, is one of the most noticeable and characteristic pathological features noted.

The report is based on the determination of about 3200 specimens collected. These have been deposited in the mycological collections of the Bureau of Plant Industry, and most of them are duplicated in the herbarium of the University of Texas. Each specimen is referred to by number in the text.

For convenience of reference the diseases are grouped under ten headings: fruit trees, small fruits, truck crops, cereals, forage crops, wild and cultivated grasses, fiber plants, trees and shrubs, ornamental plants, and wild plants. Under each group the several crops are arranged alphabetically with their several maladies. The fact that the territory has been previously little explored has resulted in the finding of a large number of new fungi, which have been described by the authors in Mycologia, vol. 3, (1911), pp. 5 to 22. An index to literature of 51 titles is appended. W. A. ORTON.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 704th meeting was held on February 10, 1912. Two papers were read: *Constancy of wire resistance standards*: FRANK WENNER, of the Bureau of Standards. To appear in this Journal.

The Measurement of inaccessible displacements, the production of temperature uniformity, and the determination of the expansion of gas thermometer bulbs: A. W. GRAY, of the Bureau of Standards. To appear in this Journal.

The 705th meeting of the Society was held on February 24, 1912. Two papers were read. *The nitrogen scale between 300° and 600°, and a new determination of the boiling point of sulphur:* A. L. DAY and R. B. SOSMAN, of the Geophysical Laboratory. See this Journal **2**: 167. 1912.

Comparison of the nitrogen and platinum resistance scale between 300° and 600°: H. C. DICKINSON and E. F. MUELLER, of the Bureau of Standards. See this Journal **2**: 176. 1912.

The 706th meeting was held on March, 9, 1912. Two papers were read: *Experiments on the light of the sky:* C. G. ABBOT, of the Smithsonian Institution. This paper gave an outline of progress in a research on the quantity and distribution of the solar radiation received indirectly by diffuse reflection from the sky. Preliminary experiments were begun in 1905 on Mt. Wilson and were continued in 1906. Further experiments were made at Flint Island in 1907, and in 1910 on Mt. Whitney with new and improved apparatus. The relative brightness of the sky with reference to zenith distance and to distance from the sun was given. The total quantity of indirect solar radiation, as compared with the direct, proved to be about seven per cent for Mt. Whitney (4420 meters elevation) at high sun. By adding the observed direct radiation on Mt. Whitney (1.71 calories per square centimeter per minute), the indirect (0.12), and that absorbed by water vapor (0.04) the va'ue 1.87 calories was reached This was less (as it ought to be) than the intensity found for the solar radiation outside the atmosphere at the sun's actual distance on the day of observation. This latter value was 2.00 calories.

On the formation of the solar corona, and the total solar eclipse of October 10-12, 1912: L. A. BAUER, of the Carnegie Institution of Washington. The speaker gave a preliminary summary of the general observat ons thus far made regarding the formation of the solar corona and the variations exhibited during the sun-spot cycle. Lantern-slides were given in illustration. It would appear that some force, in addition to the explosive forces and the repellant action of the pressure of light, of an electric or magnetic nature, is necessary to explain the curvatures of the coronal streamers, as has already been pointed out by various investigators. Thus a detailed and persistent study of the solar corona may throw light on the question of the magnetization of the sun itself. The subject

thus becomes one of interest not alone to the astronomer but also to the magnetician.

A brief statement was made with regard to observing parties during the total solar eclipse of October 9-10, 1912, the path of totality of which passes through the northern part of Ecuador and the central part of Brazil. The Department of Terrestrial Magnetism of the Carnegie Institution of Washington is planning to place as many of its South American parties as possible along the belt of totality. The special work to be undertaken will be the necessary observations for testing whether there is an observable magnetic or electric effect during the time of totality. The plans contemplate coöperation with astronomical parties sent out by other organizations.

MR. ABBOT spoke informally of the variable light transmission for different wave lengths in a spectroscope containing ultra-violet glass, the absorption being different for different wave lengths.

MR. HUMPHREYS spoke informally of Subring's observations of the variability in the position of one of the neutral points in sky polarization, and gave an explanation of its three different observed positions

The 707th meeting of the Society as held on March 23, 1912. Two papers were read: *An account of the work of the 26-inch equatorial at the Naval Observatory:* ASAPH HALL, of the U. S. Naval Observatory. The speaker gave a brief historical account of the 26-inch equatorial telescope, and spoke of the changes that had been made in some of its parts since its installation in 1873. Lantern slides were exhibited illustrating its original and its present mounting in the new observatory.

The class of work for which the telescope has chiefly been used was mentioned and proposed work with it was outlined.

A new colorimeter: P. G. NUTTING, of the Bureau of Standards. See this Journal **2**: 183. 1912.

R. L. FARIS, *Secretary.*

GEOLOGICAL SOCIETY OF WASHINGTON.

The 250th meeting was held in the Cosmos Club January 10, 1912, and the following papers were given: *General remarks on mines, mining etc. in Peru, Chile and Bolivia.* Illustrated. HOWLAND BANCROFT.

Vanadium deposits in Peru. Illustrated. D. F. HEWETT. This paper described vanadium deposits in two districts in western central Peru, the Yauli district in which vanadium is a constituent of asphaltite, and the Quisque district in which vanadium is found as the sulphide, associated with vanadiferous bitumens. The two districts are situated on the east slope of the Andes, at altitudes of 15, 300 and 16,200 feet respectively.

The Yauli deposits are numerous lenses of asphaltite lying parallel to the steeply dipping bedding-planes of Jurassic thin limestones and shales. The largest lens is 550 feet long and 22 feet wide. A dike of igneous rock lies parallel to the bedding planes in the footwall. Chemical data were given which indicated the association of vanadium with the bituminous material. The deposits are not exploited for vanadium at present.

The Quisque deposit, 80 miles northwest, was discovered in 1905. Vanadium is found as the sulphide, patronite, which is one of three substances forming a dike-like mass which fills a fault-fissure in Cretaceous shales. The deposit is in the center of an area in which igneous activity has been intense. The three substances composing the dike, are patronite, a sulphide of Vanadium; quisqueite, a highly sulphuretted bitumen; and a substance composed almost wholly of carbon. Analyses of the substances as well as microphotographs were shown which indicate their origin. The dike appears to have been forced into the fault fissure when molten; quisqueite and carbon segregated successively and patronite forms the eutectic of the mass.

By oxidation of the sulphide of vanadium a heavy gossan of oxidized minerals was formed, in which three new vanadates were found. The deposit is actively exploited and is the source of most of the vanadium of the market at present.

Remarks on the geology of the Panama Canal Zone. D. F. McDONALD and T. WAYLAND VAUGHAN.

The 251st meeting was held in the Cosmos Club January 24, 1912.

New dolomite formations in Alabama. CHARLES BUTTS. In a recent survey of the Birmingham district, Ala., three new dolomite formations have been recognized, which were included in the reports of the Alabama Geological Survey in the lower part of the Knox dolomite. These are named, in descending order, the Potosi, Ketona, and Brierfield dolomites. The Brierfield is a steely-gray, highly siliceous formation 1200 feet thick. Some samples carry 40 per cent silica. The silica is mostly disseminated in the forms of quartz, filling small cracks and replacing the dolomite. On weathering the silica forms on the dolomite a crust which is either cavernous or covered on the outside with an irregular network of narrow ridges, giving a highly characteristic appearance, by which the formation can be recognized easily and certainly. The name is from Brierfield, Ala. The Ketona is a light-gray, coarse-grained, and very pure dolomite, running generally less than 2 per cent of insoluble matter. It is 275 to 800 feet thick. This rock is used for flux almost exclusively by the smelting furnaces of the district. The name is from Ketona, a quarry town several miles north of Birmingham. The Potosi is almost identical in character with the Brierfield and 275 to 500 feet thick. It is correlated with the Potosi dolomite of Missouri, whence the name. The Potosi and Brierfield dolomites are known only in the southwest corner of the Bessemer quadrangle, while the Ketona extends throughout the Bessemer and Birmingham quadrangles.

The Brierfield dolomite overlies the Conasauga limestone, the top of which is correlated with the top of the Nolichucky shale in Tennessee, where the Nolichucky is immediately overlain by the typical Knox dolomite. In Alabama, however, where the three new dolomites described above occur, the Potosi dolomite is overlain by the Knox dolomite, which is the equivalent of the Knox of Tennessee. Therefore in the Tennessee section there is a hiatus between the Knox dolomite and the Nolichucky shale which in Alabama is filled in part by the 2500 feet more or less of dolomite described above.

Clinton problems in the Southern Appalachians. E. O. ULRICH.

On certain constituents and the genesis of coals. REINHARDT THIESSEN.

Coals are chiefly composed of residue consisting of the most resistant components of plants, of which resins, resin-waxes, waxes and higher fats, or the derivatives of these, are the most important.

Living plants are chiefly composed of celluloses and proteins. The former comprising by far the larger bulk, constitutes the framework, while the latter is concerned in the vital functions. With these are associated other substances, among which are starch, sugars, fats, and oils which constitute reserve food-stuffs; waxes, resin-waxes, resins, and higher fats which perform mainly protective functions—as in cuticles, spore-exines, pollen-exines, bark, and waxy coverings; and resins and gums which are waste products.

These components differ very markedly in their resistance to various agencies. Those substances involved in the life and support of the plant are relatively labile, whereas those which perform some protective function, or are to be looked upon as waste products, are relatively very stable. The various members of these groups, of course, differ much in stablility and the first group as a whole may over-lap upon the second in this respect. The celluloses, for example, which form a complex, represented by a series of substances, like cuto-cellulose, true-cellulose, ligno-cellulose, hemi-cellulose, oxy-cellulose, lignin, xylan, pectine and nucine, differ considerably and stand about in the order given in their resistance to decomposing agencies. Of all the substances the resins, waxes, resin-waxes and higher fats are the most resistant.

At the death of the plants, governed by various conditions imposed in the deposit, a partial decomposition, maceration, elimination, and chemical reduction begins, brought about chiefly by organisms, mainly fungi at first and bacteria later. The least resistant components are removed first leaving the more resistant behind in a residue called peat. Peat contains a large amount of cellulose, possibly in a changed condition. The process of decomposition, begun in the peats, chiefly by biochemical means, is taken up and continued by dynamochemical means into and through the later stages and results in the various grades of coal, such as lignites, subbituminous, bituminous, cannel, and anthracite.

Of these coals, as far as examined microscopically, the lignites show a marked elimination of cellulosic components and a decided concentration of resins cuticles, spore-exines, and pollen-exines as compared with the peats. The subbituminous coals, although of the same or nearly the same age as the lignites, and originally of similar composition and origin, have been subjected to greater dynamochemical agencies and show a far greater reduction of cellulosic components and a greater concentration of resins, cuticles and exines than the lignites, and are composed largely of the latter groups of substances. In the bituminous coals, the concentration of resins, exines, and cuticles or their derivatives, is such that the coals are chiefly composed of these. The cannel coals are almost wholly composed of spore-exines, or the derivatives of the compounds composing them.

The degree of decomposition depends upon the species, kinds of parts, organs and products of the plants that contributed to the deposit originally, the efficiency and duration of action, chiefly of the biochemical agencies during the peat stages, and the efficiency and duration of the action of the dynamochemical agencies during the coal stages. The greater the efficiency of the agencies during the biochemical stages and of the dynamochemical agencies, and the longer the time of their activities, the greater the concentration of the more resistant components.

The paper was illustrated by lantern slides from photographs of thin sections of the various grades of coal.

ROBERT ANDERSON, *Secretary.*

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 496th regular meeting was held at the Cosmos Club, March 16, 1912.

Under the head of *Brief notes and exhibition of specimens*, H. M. Smith exhibited a lantern slide picture of a bluebird that was found frozen fast in the opening of a hollow tree.

T. A. Palmer reported that about 250 elk have been captured during the winter in Jackson Hole, Wyoming, and in Yellowstone Park and its vicinity and have been transferred to National and State game preserves in other parts of the country.

The regular program consisted of three communications. E. W. NELSON presented translations of two extracts from the *Monarquia Indiana*, A Spanish work by Juan de Torquemada, published in 1723. The original edition was published at Seville in 1615. The first extract was an account of the Zoölogical Garden kept by Montezuma at the time of the conquest by Cortez. This large garden contained animals of all kinds indigenous to the country, and included also human albinos, dwarfs, and cripples. The care of the captive birds alone required the attendance of 300 servants. The fish-eating birds required 250 pounds of fish, and the flesh-eating mammals, the killing of 500 fowls each day. The Spaniards were greatly astonished at the display.

The second extract from the book was an account of a great hunt given by the Aztecs in honor of the Viceroy Don Antonio de Mendoza in 1540. On the day of the hunt more than 15,000 Indians went out very early in the morning and surrounded over five leagues square of land. They advanced from all sides and by noon had formed a circle man to man in the midst of which were a prodigious number of deer, rabbits, and coyotes. On account of the vast amount of game, openings were made in the circle and a part of the animals permitted to escape. The lines were then reformed and the people moved up until the enclosure was little more than a half league square and the Indians formed a wall two or three men deep. The killing then began and resulted in the destruction of 600 deer, 100 coyotes, and great multitudes of foxes, hares, and rabbits. The prong horn antellope was mentioned among

the deer, this being the most southerly record ever made for this animal and being hundreds of miles south of its present range.

The second communication was by W. E. SAFFORD on *Cymbopetalum penduliflorum*, the ear-flower of the Aztecs. Among the plants brought from a distance to be planted in the gardens of the Aztec emperor was the *xochinacaztli*, or ear-flower, the aromatic, ear-shaped petals of which were used for flavoring chocolate. The botanical identity of this plant has remained unknown until recently, when it was established by the author of the present paper.[1] An account of it was first written about 1569 by Padre Bernardino de Sahagun, who called it *teunacaztli*, "the sacred ear," and said that it was much used for its fragrant odor and for drinking, ground up with chocolate. Dr. Francisco Hernandez, sent by Philip II, in 1570, to study the resources of New Spain described it under the heading "De Xochinacazli, seu Flore auriculæ." The description, in Latin, together with an imperfect and rude figure, was published in 1651, in the Roman edition of his work, prepared by Antonio Recchi; but a translation of this work into Spanish, by Fray Francisco Ximenez, without illustrations, had already appeared in the City of Mexico in 1615.

The tree is described as bearing long narrow leaves of a deep green color. The flowers, borne on a pendent peduncle, have petals purplish within and greenish without, shaped almost exactly like ears and having a very agreeable odor. It is a native of the *tierra caliente*, and in the *tiangues* and markets of the Indians there is nothing else more frequently found nor more highly prized than this flower, "the which is wont to give the greatest charm and taste, together with a very fragrant odor and flavor to that celebrated drink cacao, which they call *chocolate*, and it imparts to it certain tonic properties and wholesomeness as well. It is said that when drunk in water this flower dispels flatulency, causes phlegm to become thin, warms and comforts the stomach which has been chilled or weakened, as well as the heart; and that it is efficacious in asthma, ground to a powder with addition of two pods of the large red peppers called *texochilli*, with their seeds removed and toasted on a *comal*, which is a kind of griddle on which the natives toast and make their bread called by us *tortillas*, adding to the same three drops of balsam and taking it in some suitable liquor."

Since the time of Hernandez many works have appeared in which the economic plants of the Aztecs are discussed, including the recent *Notes sur la medecine et la botanique des anc ens Mexicains*, by the Rev. A. Gerste, of the Society of Jesus, Rome, 1910. In none of these is the botanical identity of the *xochinacaztli* hinted at, though it is invariably mentioned.

The author of the pre:ent paper while working on the botany of the Annonaceæ, came across a photograph of annonaceous flowers, with ear-like petals, in the files of the Bureau of Plant Industry.[2] These

[1] *See Science*, 33: 470, *March 24, 1911*

[2] See Smithsonian Report for 1910, p. 428. 1911

flowers were found by Mr. O. F. Cook in 1904 in the market of Coban, a town situated in the department of Alta Verapaz, Guatemala. The photograph was unaccompanied by notes as to the uses to which the flowers are applied, but in his journal Mr. Cook states that at Coban the flowers of an Anona were offered for sale both fresh and in the form of dried black petals curled up on the edges and heavily veined inside; and that they had a pleasant spicy odor. He describes the sepals and three outer petals as light green and the three inner thicker petals as pale dull salmon colored, breaking with a bright orange-colored fracture. No specimens of the plant were collected at this time, but on May 30, 1906, two years afterward, Mr. Cook collected an Annonaceous plant at Jacaltenango, Guatemala, which he did not associate with the flowers of the Coban market so beautifully photographed by Mr. C. B. Doyle, his assistant. The specimens in the U. S. National Herbarium (sheet no. 574411) consisted of young branches with leaves and flowers. It was a simple matter to test the nature of the petals by chewing one of them They proved to be pungently aromatic, suggesting the flavor of nutmeg or perhaps of cubebs. The identity of the *xochinacaztli* was revealed. From its taste it seemed to have been appropriately placed, as Hernandez had placed it, among the spices.

Cymbopetalum penduliflorum, first described by Dunal, in 1817, from drawings made by Mociño and Sessé, without any indication of its aromatic properties or its common name, is endemic in the forests of northwestern Guatemala and southern Mexico. Closely allied to it are two other species *Cymbop talum stenophyllum* Donnell Smith, and *Cymbopetalum costaricense* (Donnell Sm.) Safford. It is not yet known whether the flowers of the latter species are aromatic like those of the species above described. *Cymbopetalum costaricense* was described by Captain John Donnell Smith from specimens accompanied by fruit but without flowers as *Asimina costaricensis*. The fruit, which consists of a cluster of oblong berries, containing a number of seeds, formed from the individual carpels and radiating from a common receptacle, strongly suggests that of our common *Asimina triloba*, though considerably smaller, and it is not surprlsing that in the absence of flowers Captain Smith should have placed it in the genus Asimina. Its true generic position was determined by flowering specimens in the National Herbarium (sheet no. 592582) collected by Professor Henri Pittier, accompanied by immature fruit and the characteristic flowers of Cymbopetalum, with their 3 inner ear-shaped petals. Professor Pittier's specimens (ex Herb. H. Pittier no. 13459) were collected by him in July, 1899, on the banks of the Rio Blanco, Santa Clara, Costa Rica, at an elevation of 300 meters.

Mr. Safford's paper was illustrated with many lantern slides from photographs and drawings of the plants mentioned.

The third paper was by H. L. Shantz and L. J. Briggs on *The wilting coefficient as an aid in the study of plant associations.* (See Bull., Bureau Plant Industry No. 230).

D. E. Lantz, *Recording Secretary.*

ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The 458th regular meeting was held in the New National Museum, February 6, 1912. Professor MITCHELL CARRELL presented a paper entitled *The excavations at Knossos or labyrinth of Minos*, illustrated.

On February 20 the retiring president, DR. J. W. FEWKES, made an address on *Great stone monuments in history and geography*, in the New National Museum. This paper wi l appear in full elsewhere.

The 459th regular meeting was held in the New National Museum, March 12, Miss DENSMORE read a paper on the *Sun dance of the Teton Sioux*. This was based upon a study made among the Teton Sioux on the Standing Rock reservation in North Dakota and represents the usage in that band of the tribe. The study was conducted in a series of councils to which the old leaders of the tribe came from a radius of about 100 miles. Fifteen reliable men were selected to give the account of the dance, their authority being established by interviews with about forty members of the tribe, in widely separated localities. Those who took part in the councils were men who bore upon their bodies the scars of their participation in the sun dance tortures, and among them were the man who acted as intercessor in the ceremony and the man who "did the cutting of those who fulfilled vows," both men being the only Tetons living who had performed these official acts. The men comprising the sun dance council, with the speaker and an interpreter, visited the site of the last sun dance held by the Teton Sioux in 1882, the site being identified by the Indians. The place where the dance pole was erected, the outline of the "shade-house" and the location of the "sacred place" were recognized and measurement showed them to be correct, according to the usual plot of the sun dance grounds.

This dance was held annually by the Sioux and was distinctly a religious ceremony. The fulfilling of vows of torture was an important part of the ceremony, the vows having been made by men in danger on the war-path. When making the vow they asked for a safe return and that they might find the members of their family alive and well, and the fulfilment of the vow was required whether the prayer was granted or denied.

The paper was illustrated by songs of the sun dance which had been recorded by the phonograph and were played on the piano. Many of these were ceremonial songs and known only to the man who sang them for the speaker. One of these men has died since the songs were recorded. A collection of old ceremonial articles used in the sun dance was also exhibited.

The 460th regular meeting was held April 10 in the New National Museum. Professor PITTIER delivered an address on *Notes on the native tribes of Panama*, with all of whom he came in contact in the course of his recent travels in the Canal Zone.

There is much confusion current as to the number of the so-called tribes and the stocks to which they are related. The many names recorded correspond in fact not to distinct tribes, but merely to villages, names of chiefs, or, in a general way, to what the old Spanish chroniclers used to design as "parcialidades."

In the present time, there are east of the Canal Zone only two distinct "nations," viz., the Cunas, or Cuna-Cuna, to which the San Blas Indians belong, and the Chocoes to the South, beyond the Tuyra River. The line that separates these two stocks is at the same time the ethnological boundary between South and Central America.

The Cunas are a numerous and strong race, almost uniformly of short stature and broad shoulders. They are very jealous of their independence and shun all interference on the part of strangers, including the Panamanian government, the authority of which over them is only nominal. The Cunas of the northern coast, east of Nombre de Dios, or San Blas Indians, are far above the other Panamanian aborigines in their social and economic development; they constitute one of the best elements of the population included in the territory of the young republic, being thrifty and enterprising and having made of their extensive coconut palm plantations a real source of wealth. The remaining Cunas, known as Bayanos, Chucunacas and Payas, live in the interior and are less advanced, the two former groups being acknowledged as real "Indios bravos." All speak one language, with slight local variations.

The Panamanian Chocoes are but the northernmost branch of a numerous stock which extends more or less continuously along the Pacific coast of South America, from Punta Garachine in Darien, to the Ecuadorian boundary. In the Sambu Valley, where Professor Pittier found them, they are a happy lot, usually tall and well built, scantily clothed and living near to nature.

West of the Canal Zone, in the mountains of Veraguas and eastern Chiriqui, live the ploygamous Guaymies, once under the care of the Spanish missionaries, but who have long since gone back to their own independent life and customs. They do not however avoid or repel the contact with the other natives, and owing to the rapid expansion of the neighboring populations, so-called civilized, the Guaymies are doomed soon to lose their characteristic and individuality as a race. Certain ethnological traits, as well as their physical appearance point to a relationship with Costa Rican tribes.

In consequence of what Professor Pittier calls a "caprice of arbitration," the Republic of Panama has acquired the northern branch of the Térrabas or Tirúb of Costa Rica. These dwell in small and rapidly dwindling numbers at the headwaters of the Tararia or Tilorio, the main branch of the Changuinola River. They have been investigated by Pittier in the course of his survey of Costa Rica.

These four are the tribes represented today in Panama. The Dorasques, supposed by some to descend from the great Chiriqui pottery makers, seem to have disappeared, unless the Brunka of Costa Rica are really what is left of them.

With reference to the possible affinities of the Panamanian tribes with the neighboring stocks, the speaker took absolute exception to the theory of the Chibchan relationship, which he was one of the first to advocate about twenty years ago and which has since received general acceptation under the authority of Brinton, Deniker, and others. The assumed

relationship is founded merely on linguistic analogies and on the apparently common origin of a number of words. But these facts can be taken as conclusive only if supported by common anthropological characteristics and also by partial community of uses and customs. Physically, the Cunas are strikingly distinct of the Guaymies and the Costa Rican Indians, and both stocks offer none but general racial likeness to what is left of the original Chibchas. In the opinion of Professor Pittier the origin of the Cuna-Cuna has to be looked for elsewhere than in the interior of Columbia, and the Guaymies, Valientes, Bribri, Térrabas, Sumos, etc., are more likely to be the remnants of a primitive autochtonous stock. Pittier's talk was illustrated by lantern-slides and by objects collected among the Chocoes and Guaymies.

TRUMAN MICHELSON, *Secretary.*

PROGRAMS AND ANNOUNCEMENTS

WASHINGTON ACADEMY OF SCIENCES AND THE PHILOSOPHICAL SOCIETY OF WASHINGTON

A joint meeting of Academy and Philosophical Society will be held Saturday evening, May 4, 1912, at the Cosmos Club. Professor DAYTON C. MILLER of the Case School of Applied Sciences will speak on *Sound waves; how to photograph them and what they mean.* To be illustrated by lantern slides, apparatus and experiments.

THE CHEMICAL SOCIETY

The 216th regular meeting will be held Thursday evening, May 9, 1912, at the Cosmos Club. Dr. H. M. WILEY will speak on *The value of chemistry to the medical profession.*